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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/563,353	01/03/2006	Masahide Matsuura	28955.4040	8821

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STEPTOE & JOHNSON LLP
1330 CONNECTICUT AVENUE, N.W.
WASHINGTON, DC 20036

EXAMINER	
NELSON, MICHAEL E	

ART UNIT	PAPER NUMBER
1794	

MAIL DATE	DELIVERY MODE
05/28/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/563,353	MATSUURA ET AL.
	Examiner	Art Unit
	MICHAEL E. NELSON	1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 January 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 January 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date *01/03/2006,10/10/2007*.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-13 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for some compounds, does not reasonably provide enablement for the full scope of the claims. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims.

3. Case law holds that applicant's specification must be "commensurately enabling [regarding the scope of the claims]" *Ex Parte Kung*, 17 USPQ2d 1545, 1547 (Bd. Pat. App. Inter. 1990). Otherwise **undue experimentation** would be involved in determining how to practice and use applicant's invention. The test for undue experimentation as to whether or not all compounds within the scope of claims 1-13 can be used as claimed and whether claims 1-13 meet the test is stated in *Ex parte Forman*, 230 USPQ 546, 547 (Bd. Pat. App. Inter. 1986) and *In re Wands*, 8 USPQ2d 1400, 1404 (Fed.Cir. 1988). Upon applying this test to claims 1-13, it is believed that undue experimentation **would** be required because:

(a) *The quantity of experimentation necessary* is **great** since claims 1-13 read on an extremely large number of compounds for the host and electron transport

materials, based only on physical properties while the specification discloses a handful of compound classes for the host materials, including anthracene derivatives, styryl derivatives, aromatic amines, aluminum chelates having mixed ligands and carbazole derivatives (page 11), and a general class of Formula (1) for electron transporting materials.

(b) There is **no** *direction or guidance presented* for predicting the physical properties of the compounds, short of testing each and every compound.

(c) There is an ***absence*** *of working examples* concerning which compounds meet the required criteria, with only 2 compounds illustrated for the electron transporting materials, with closely related structures, and a single host material.

4. In light of the above factors, it is seen that undue experimentation would be necessary to make and use the invention of claims 1-13.

5. Claims 1-13 require at least two light emitting layer with a host material, where each layer has a host having a particular energy gap (less than or equal to 2.9 eV), and an electron transport layer comprising a heterocyclic material also having a particular energy gap (less than 2.9 eV), and a relationship between the electron transport material and the host material based upon the ionization potential of the two materials.

6. In order to make the invention within the full scope of the claims, an individual of ordinary skill must measure both the ionization potential and energy gap for each potential compound. Methods for determining the values are given in the specification, but there are other commonly used methods, and results can vary significantly depending on the method used. Each measurement requires different equipment. As a

result, one of ordinary skill must resort to trial and error to determine which compounds fall within the scope of the claims, and which do not. Given the extremely large number of compounds within the scope of the claims, this would exceed the level of undue experimentation.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. Claim 9 describes the substituent HAr. The Second section, describing formula (A) begins with "wherein a plural R^1 each independently represent." However, there is no R_1 in the structure (A) or in the preceding claims. However, there is an R', which is also described as "representing a same atom or group as that represented by R^1" However, R' is also mentioned in the substituent NR', so it is unclear to which R' the claim refers. The specification does not clarify this issue, where the same description is given on page 36, lines 14-22.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 1-4 are rejected under 35 U.S.C. 102(e) as being anticipated by Hatwar et al. (6,967,062) with evidence of inherency supplied by Lim et al. (Journal of Organometallic Chemistry, vol. 691, pp. 2701-2707, 2006).

11. Concerning claim 1, Hatwar et al. describe an white light-emitting OLED device having a blue light-emitting layer doped with an electron-transporting or hole transporting material, or both (title), which has a pair of electrodes (anode (420) and cathode (470), at least two light emitting layers (450) which emits blue, and (441) which emits yellow light, and an electron transport layer (460) (Fig. 4, column 15, line 64-column 16, line 5).

12. The material of the blue light emitting layer comprises a host material, including anthracene compounds, such as TBADN, ADN, DPVBi, and 9,10-bis[4-(2,2-diphenyletheynyl)phenyl]anthracene (which is identical to Applicant's material DPVDPAN, named on page 52, lines 2-3 of the specification), which would inherently have an Ionization potential of 5.7 eV and a energy gap of 3.0 eV (as given on page 52, lines 3-4 of the specification). The yellow emitting layer has a host material of NPB (similar to applicant's material TBTB, being a diamino-biphenyl compound, and given the close similarity in structure would be predicted to inherently have an ionization potential and energy gap close to TBTB (5.5eV and 3.1 eV) respectively.

13. The material for the electron transport layer include chelated oxinoid compounds including materials such as Alq, Lithium Oxine, and BAlq (specifically, 1,1'-biphenyl)-4-olato)bis(2-methyl-8-quinolinoato N1, O8)aluminum. (column 7, lines 34-50) Hatwar et al. do not report the energy gap and ionization potential for BAlq, but the properties are an inherent feature of the material itself, and are reported by Lim et al. in Table 1, page 2705. The ionization potential is the same as the E^{HOMO} value, which is 5.88 eV, and the Energy gap is the E_g value of 2.97 eV.

14. The Energy Gap of Balq is 2.97 eV (greater than 2.9 eV), and the Ionization potential of BAlq is 5.88 eV, which is less than 6 eV (5.7 + 0.3).

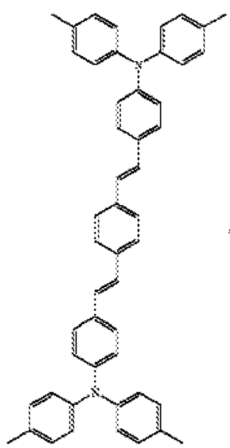
15. Concerning claim 2, given the values for the ionization potentials above, it is clear that the relationship 2.9 eV < Eg(ETM) ≤ Eg(Host-i) is met.

16. Concerning claim 3, the yellow light emitting layer is doped with rubrene, which inherently has an energy gap of 2.2 eV (less than 2.9 eV) (as disclosed on page 33 of Applicant's specification).

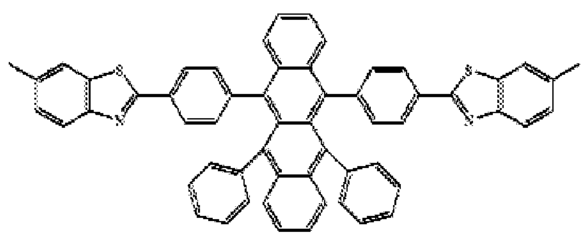
17. Concerning claim 4, Hatwar et al. describe the device discussed above, where there are two light emitting layers, one of which emits blue light, and one of which emits yellow light (different wavelengths of light emission).

18. Claim 5 is rejected under 35 U.S.C. 102(e) as being anticipated by Hatwar et al. (6,967,062) with evidence of inherency supplied by Lim et al. (Journal of Organometallic Chemistry, vol. 691, pp. 2701-2707, 2006) and Hatwar (7,037,601).

19. Concerning claim 5, Hatwar et al. describe the organic electroluminescent device discussed above, but do not state the specific wavelengths of emission of the materials in the device. The emission wavelength is an inherent feature of the materials in the device. Hatwar (7,037,601) describe a white emitting device comprising a blue light emitting material of formula 2, and a yellow material DBzR, which are identical to materials described in 6,967,062. As shown in Fig. 7 of (7,037,601) (Ex 2-6), the maximum emission peak is above 550nm, while the second greatest is near or below 500nm, resulting in a difference of greater than 50nm.



Formula 2



DBzR

Claim Rejections - 35 USC § 103

20. Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatwar et al. (6,967,062) with evidence of inherency supplied by Lim et al. (Journal of Organometallic Chemistry, vol. 691, pp. 2701-2707, 2006) as applied to claim 1 above, and further in view of Nakamura et al. (6,509,109).

21. Concerning claims 6-7, Hatwar et al. describe the organic electroluminescent device discussed above. Hatwar et al. are silent where the electron transport layer comprises a metal having a work function of 2.8 eV or smaller.

22. Nakamura et al. describe organic electroluminescent devices where the electron injection region comprises an electron transporting compound and a reducing dopant having a work function of at most 2.9 eV. Nakamura et al. disclose that the electron transporting compound has nitrogen containing hetero ring structure and should have a high electron affinity and charge transfer capability (column 12, lines 52-60). Preferably included are metal complexes with a ligand of 8-quinolinol, such as those materials described by Hatwar et al. for use as electron transport materials. (column 12, line 61 column 13, line 6). Preferred reducing dopants are Na (work function 2.36 eV), K (2.28 eV), Rb, (2.16 eV) and Cs (1.95 eV). (column 15, lines 24-29) Nakamura et al. disclose that the use of the specific reducing dopant in the electron injection (electron transport) layer results in a device with a reduced driving voltage, increased luminance and increased lifetime. (column 2, lines 5-10)

23. Given this teaching, it would have been obvious to one of ordinary skill in the art to dope the electron transporting layer described by Hatwar et al. for the purpose of reducing the driving voltage, increasing the luminance and lifetime of the device.

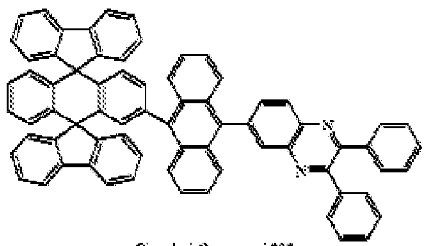
24. Claim 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatwar et al. (6,967,062) with evidence of inherency supplied by Lim et al. (Journal of

Organometallic Chemistry, vol. 691, pp. 2701-2707, 2006) as applied to claim 1 above, and further in view of Kim et al. (WO 02088274).

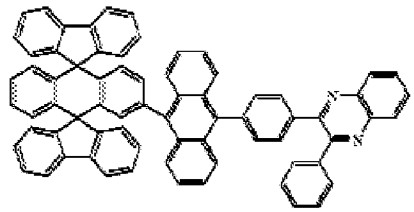
25. Concerning claims 8-13, Hatwar et al. describes the white light emitting organic electroluminescent device discussed above. Hatwar et al. are silent on the use of electron transporting materials of the specific structures in the electroluminescent device.

26. Kim et al. describe double spiro compounds, including those with electron transporting properties. Kim et al. specifically discloses that compounds having the structures of compounds 200-222 are preferred as electron transporting materials. (page 35, lines 21-23) Among those compounds preferred as electron transporting materials are compounds 203 and 209 shown below. (page 19) Kim et al. disclose that the band gap of the compounds is generally between 1.8 eV and 3.5 eV. (page 3, lines 19-20) Since the bandgap is determined primarily by the largest conjugated unit (in this case anthracene), it would be reasonable to predict that the bandgap would be similar to the anthracene compounds described in the specification (near 3.0) (greater than 2.9 eV), and Kim et al. further report that the HOMO level (absolute value (HOMO) = ionization potential) is generally between 4.0 and 6.0 eV (page 3, lines 25-26), which would necessarily mean that they would have an ionization potential less than 6.0 eV, based on the host materials described by Hatwar et al., which have an ionization potential of 5.7 eV, as discussed earlier. Kim et al. further disclose that the spiro compounds described have high molecular weights and therefore higher melting points and glass transition temperatures, enhanced sublimability, and reduces crystallinity

(page 12, lines 3-12), which are important factors for improving device stability and efficiency. (page 9, lines 19-page 10, line 24)



Chemical Compound 203



Chemical Compound 209

27. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the electron transporting compounds described by Kim et al. in the electron transporting layer of the device described by Hatwar et al. for the purpose of increasing the thermal stability, glass transition temperature of the layer, and reducing the crystallinity of the material to improve the efficiency and stability of the device.

28. Concerning claims 8-13, the compounds described above have the general structure where HAr is a quinoxaline (structure (9), per claim 9), and compound 203 above has the diphenylquinoxaline structure (37) (per claim 10). Compound 209, has a quinoxaline compound, where L is phenylene (structure (45) per claim 11) and Ar^1 is a disubstituted anthracene (per claim 13). In both compounds, Ar^2 is a phenyl ring (structure (47), per claim 12), with two substituents which combine to form the double spiro compound, where the two substituents each have less than 20 carbons.

Conclusion

29. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Xie (US 2003/0215667), Yoon et al. (6,878,469) also describe

anthracene containing electron transporting materials. Fukuoka et al. (2002/0168544) also teaches white light emitting devices.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL E. NELSON whose telephone number is (571)270-3453. The examiner can normally be reached on M-F 7:30am-5:00pm EST (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on 571-272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael E. Nelson
Examiner
Art Unit 1794

/Callie E. Shosho/
Supervisory Patent Examiner, Art Unit 1794